**Lesson Four: “***Performing Scientific Notation Operations”*

**Addition & Subtraction**

When adding or subtracting in scientific notation, you must express the numbers as the same power of 10. This will often involve changing the decimal place of the coefficient.

**REMINDER**:

This is like our exponent rules, we can only combine (add/subtract) *like terms*.

By moving the decimal place, we can manipulate our numbers expressed in scientific notation. This allows us to create like terms which we can then combine.

Example: Add 3.76 x 104 and 5.5 x 102

First, you must move the decimal to create like terms

So 5.5 x 102 becomes 0.055 x 104

Here we moved the decimal **two** spaces to the left which meant we added **two** to the exponent

Then, add the coefficients and leave the base and exponent the same:

3.76 + 0.055 = 3.815 x 104

The same idea applies to subtraction. However, you must ensure you subtract the coefficients in the correct/given order.

Example: Perform the indicated operation: (7.83 x 10-2) - (2.20 x 10-3)

First, we move the decimal to create like terms

So 7.83 x 10-2 becomes 78.3 x 10-3

Here we moved the decimal **one** space to the right (which is like multiplying by 10), which meant we subtracted **one** from the exponent

Now we can subtract the coefficients and leave the base the same

78.3 – 2.30 = 76.1 giving us 76.1 x 10-3

Although this answer is numerically correct, it is not in proper scientific notation. The number in front of the decimals (in the units position), must be between 1 and 9.

So…

76.1 x 10-3 becomes 7.61 x 10-2

**Multiplication & Division**

When *multiplying* two numbers in scientific notation, you multiply the coefficients together, then powers of ten are added (add the exponents).

Example: Perform the indicated operation: (4.42 x 10-3) x (4 x 10-2)

**REMINDER**:

This is like our exponent rules. When we multiply numbers exponents of the same base, we add the exponents.

(4.42 x 10-3) x (4 x 10-2)

= (4.42 x 4)(10-3 x 10-2)

= (17.68 x 10(-3 + -2))

= 17.68 x 10-5

Once again, we must check that our solution is in proper scientific notation form

= 17.68 x 10-5

= 1.768 x 10-4

When *dividing* numbers in scientific notation, we divide the coefficients (in the given order), and then the powers of ten are subtracted (subtract the exponents).

Example: Perform the indicated operation: (3.5 x 10-2) ÷ (5 x 106)

So…. (3.5 x 10-2) ÷ (5 x 106)

= 0.7 x 10(-2 – 6)  = 0.7 x 10-8

**Power Raised to a Power**

Multiplication/Division:

Sometimes we will encounter problems where we are asked to multiply or divide numbers expressed in scientific notation that have also been raised to a power.

Example: [(2.3 x 10-2)(1.5 x 103)]2

In this case, we must first distribute the outside exponent to the inside expression (give every piece the exponent)

**REMINDER**:

This is like our exponent rules. When we encounter a power raised to another power, we multiply the exponents.

[(2.3 x 10-2)(1.5 x 103)]2

= (2.32 x 10-4)(1.52 x 106)

= (5.29 x 104)(2.25 x 106)

= 11.9025 x 1010

Now we follow the steps for multiplication ☺

= 1.19025 x 109

Addition/Subtraction:

In some cases we are asked to add or subtract numbers which have been raised to a power.

Example: [(3.2 x 10-1) + (1.09 x 103)]2

Here we must be careful. Since our values are separated by addition (or if subtraction) , we cannot simply distribute the exponent to each term.

In this case, it is easier to first simplify the inside then we can distribute the exponent of 2.

[(3.2 x 10-1) + (1.09 x 10-3)]2

= [(0.032 x 10-3) + (1.09 x 10-3)]2

= [(0.032 + 1.09) x 10-3]2

= (1.122 x 10-3)2

= 1.1222 x 10-6

= 1.258884 x 10-6

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**TEACHER NOTE**: *Use instructor textbook if additional examples are needed.*